Appendix E

Biological Evaluation
Big Creek Project
Cherokee National Forest
Nolichucky/Unaka Ranger District

The purpose of this biological evaluation (BE) is to ensure that forest management activities and habitat improvements do not contribute to the loss of viability or trend toward Federal listing of any native plant or animal species as directed in the Cherokee National Forest (CNF) Revised Land and Resource Management Plan (RLRMP) (USDA 2004). The Endangered Species Act of 1973 requires that Federal agencies not jeopardize or adversely modify critical habitat of federally listed species. This BE will document any potential effects of the proposed activities on Threatened, Endangered, and Sensitive (TES) species or their habitat and make certain that land management decisions are made with the benefit of such knowledge.

Proposed Actions and Affected Area

The proposed activities are located in Compartments 234, 237, 241-244, 249-252, 256, and 257 of the Big Creek Ecosystem Area (BGEA). Alternative A is "No Action," and only current management would continue. Table 1 lists actions proposed in Alternative B. Alternative C is the same as Alternative B, with the exception of activities listed in Table 2. A detailed description of the alternatives can be found in the Big Creek Environmental Assessment.

Table 1. Proposed Activities in Alternative B

Action	Habitat	Stage	Area
Site Preparation/Shelterwood Harvest	Deciduous Forests	Late Successional	268 acres
Post Harvest Treatments/Chestnut Planting	Deciduous Forests	Early Successional	268 acres
Clear-cut	White Pine Plantation	Mid Successional	28 acres
Overstory Removal of Shelterwood	Deciduous Forest	Sapling/Pole	28 acres
White Pine Thinning/Mast Improvement	White Pine Plantation	Sapling/Pole	36 acres
Mast Tree Release	Deciduous Forests	Sapling/Pole	176 acres
Midstory Treatments/Mast Improvement	Deciduous Forests	Late Successional	474 acres
Daylight Roads	Mixed Forests	Mixed	12.6 mi/153 ac
Road Maintenance	-	-	17.3 miles
Temporary Road Construction/Gate Installation	-	-	0.3 miles
Non-native Invasive Species Control	Mixed Forests	Mixed	1,108
Wildlife Opening Maintenance	Permanent Openings	Grass	26
Old Field Restoration	Permanent Openings	Early Successional	2
Waterholes	-	-	8 ponds
Nest/Roost Boxes/Drum Logs	-	-	31 structures
Mast Shrub/Tree Plantings	-	-	32 acres
Brook Trout Restoration	Coldwater Stream	-	1.7 miles
Stream Habitat Improvement Structures	Coldwater Stream	-	26 structures
Rhododendron Thinning	Coldwater Stream	-	2.8 miles
Decommission Roads	-	-	8.12 miles
Authorize Existing Roads	-	-	3.28 miles

Table 2. Proposed Activities in Alternative C

Action	Habitat	Stage	Area
Site Preparation/Shelterwood Harvest	Deciduous Forests	Late Successional	299 acres
Post Harvest Treatments/Chestnut Planting	Deciduous Forests	Early Successional	299 acres
Non-native Invasive Species Control	Mixed Forests	Mixed	1,108

These compartments are a portion of the Big Creek watershed in Cocke County, Tennessee. Table 2 lists the terrestrial habitats available in the project area. Aquatic habitats potentially impacted include 17 miles of coldwater streams and several waterholes. Elevations of affected areas range from 1,800 to 3,800 feet MSL.

Table 3. Terrestrial Habitats of the BGEA

Major Forest Communities	**Acres**	**Percent of** BGEA
Mesic deciduous (MDF)	10,376	61.8%
Eastern hemlock & white pine (EHWPF)	1,497	8.9%
Oak & oak-pine (OOPF)	8,188	48.8%
Successional Habitats	**Acres**	**Percent of** BGEA
Early successional (ESF)	6	0.0%
Sapling/pole (SPF)	3,171	18.9%
Mid-successional (MSF)	7,248	43.2%
Late-successional & old growth (LSOG)	6,284	37.5%
Other Terrestrial Habitats	**Acres**	**Percent of** BGEA
Permanent openings (PO)	98	0.6%
High elevation shrubby habitats (HESH)	6	0.0%
Riparian (RF)	2,635	16%
Snags, dens, downed wood (SDDW)	13,532	80.7%

Scope of Analysis

The scope of this analysis for direct and indirect effects on TES species includes the 16,777 acres of Forest Service lands within the BGEA. For viability concerns and cumulative effects, the scope of the analysis includes the entire CNF to address Goal 10 in the RLRMP to maintain viable populations of all native species across the CNF. The period of time used in this analysis is up to 20 years after completion of the work, and 20 years before present time for cumulative effects. Conditions would continue to change within individual treatment areas for a much longer period of time, but conditions at the project level after 20 years would resemble conditions present today.

Methods Used and Species Evaluated

This BE addresses TES species that are considered to occur or have habitat on the CNF. Analysis of the project was conducted using the best available science, including references from science-based websites, books, papers, reports, state and federal databases, field surveys, and professional opinion based upon 19 years of work on the CNF.

The Threatened and Endangered Species List on the CNF (Barclay 2002) and the 2001 Sensitive Species List for Region 8 were reviewed to determine TES species to consider. Each species, listed in Attachment A, was evaluated and given a Project Review Code (PRC) using a list (Attachment B) for evaluation. The process, used to decide when to inventory for TES species, is consistent with FSM 2672.43. Some of the PRC's are used for a Determination of Effect.

Table 4. Biological Surveys Used in Analysis

Survey	Year	Methods	Location
Plants	2006	Intuitive Control	Treatment Stands
Bats	2006	Mist Netting	Round Mtn Rd & Gulf Tract
Salamanders	2002-6	Timed Search	Across BGEA
Snails	2004-6	Timed Search/Leaf Litter	Across BGEA

Information from field surveys (Table 4) and TES database maps identified species known to occur in the project area. Habitat conditions were obtained from survey results and Big Creek Ecosystem Assessment reports (Carter 2008 & 2009). Project area habitats, species habitat requirements, distributions and limiting factors were used to determine if additional TES species were likely to occur in the project area. Based on this process, the following species (Table 5) are analyzed for effects.

Table 5. TES Species Analyzed for Effects

Scientific Name	Common Name	Status	Group
Desmognathus carolinensis	Carolina Mountain Dusky Salamander	Sensitive	Amphibian
Plethodon teyahalee	Southern Appalachian salamander	Sensitive	Amphibian
Speyeria diana	Diana fritillary	Sensitive	Butterfly
Corynorhinus rafinesquii	Rafinesque's big-eared bat	Sensitive	Mammal
Myotis grisescens	Gray bat	Endangered	Mammal
Myotis leibii	Eastern small-footed bat	Sensitive	Mammal
Myotis sodalis	Indiana bat	Endangered	Mammal
Vertigo bollesiana	Delicate vertigo	Sensitive	Snail
Juglans cinerea	Butternut	Sensitive	Vascular Plant
Penstemon smallii	Small's beardtongue	Sensitive	Vascular Plant
Prenanthes roanensis	Roan Mountain rattlesnake root	Sensitive	Vascular Plant
Silene ovata	Blue Ridge catchfly	Sensitive	Vascular Plant

EFFECTS AND DETERMINATION OF EFFECTS

Threatened and Endangered Species

Gray bat *(Myotis grisescens)* is found throughout southern, Midwestern and southeastern U.S. (Whitaker and Hamilton 1998). They use caves year round for hibernating, maternity colonies, and roosting. Most individuals migrate seasonally between maternity and hibernating caves. Both hibernacula and maternity caves are known from Tennessee, but neither is known from the CNF. Gray bats forage for insects over water along riparian areas and shorelines with forest cover (Mitchell 2001). The CNF primarily provides riparian foraging habitat for nearby colonies.

An effort of forest-wide sampling from 1990 to 2007 with over 800 net nights, capturing over 2400 bats has yielded 85 captures of gray bats, including a pregnant female. Foraging habitat is available in the BGEA along approximately 2 miles of Trail Fork Big Creek, although no gray bats have been documented in the BCEA.

Alternative A – This alternative would have no direct, indirect or cumulative effects on gray bat because no action would occur. *Determination of effect* – This alternative would have a ***no effect*** determination for **gray bat**.

Alternatives B and C – These alternatives would have the same effects on gray bat and will be discussed together. All activities associated with these alternatives (Tables 1 and 2) would occur during the day while bats are roosting in caves, so there would be no contact or direct effects.

Indirect effects from Alternative B would be minimal because compliance with RLRMP standards, including the stream filter zones, would protect foraging habitat from changes associated with all activities in Tables 1 and 2, with the exception of rhododendron thinning, stream habitat improvement structures, road maintenance, and decommissioning. Felling trees (stream habitat improvements) and rhododendron thinning along Trail Fork Big Creek would allow additional sunlight to penetrate and increase insect production. This would increase forage productivity for gray bats. Rhododendron thinning would also open up flight corridors along streams, allowing bats to move further upstream, expanding their foraging range.

Decommissioning of OR7 & OR8 and maintenance of FDR3243, 3249, 22421, and 22491 would improve road conditions and help reduce sedimentation in Trail Fork Big Creek. A reduction in sedimentation could lead to improved water quality, increase insect production, and improve bat foraging conditions. All of these indirect effects would be beneficial for a period of at least five years.

Herbicides used in treatments are not likely to come directly in contact with animals or their food sources. The herbicides used are no more than slightly toxic for mammals (Tu et al 2001) and present low risk to aquatic species (SERA). The very small amounts used, direct methods of applications, timing to avoid rainfall, and streamside buffer zones minimize the risk of stream contamination and impacts to foraging habitat (insect production). With these mitigation measures in place, negative effects from herbicides are not likely. No other activities listed in Tables 1 and 2 would affect gray bat.

Cumulative effects – No past activities have had measurable effects on gray bat. Future stream habitat improvements in Trail Fork Big Creek, combined with those in Alternative B would have positive cumulative effects by improving foraging habitat.

Determination of effect – Alternatives B and C are ***not likely to adversely affect*** gray bat because activities would have beneficial effects. Informal consultation with the USDI Fish and Wildlife Service (FWS) was initiated in January 2010 and a letter of concurrence was received on May 3, 2010 (Jennings 2010).

Indiana bat *(Myotis sodalis)* occurs from Vermont to Michigan, south to South Carolina, Alabama, Indiana to Arkansas, and Oklahoma. The majority of the entire population of these bats hibernates in relatively few caves. Northern populations (primarily females) migrate south to limestone areas, including Tennessee, generally beginning in April. The maternity colonies are more widespread and can be found in upland or riparian areas under loose bark or in cavities of trees. These females require multiple alternate roost trees. They forage for flying insects along waterways, floodplains, and over upland waterholes. They return to their hibernacula beginning in late August (NatureServe 2007).

No hibernacula are known from the CNF, but one is located in the Great Smoky Mountains National Park, where several maternity roosts have been located. Four additional hibernacula are located within 40-70 miles of CNF. An effort of forest-wide sampling from 1990 to 2007 with over 800 net nights, capturing over 2400 bats has yielded only two captures (Monroe County). Since that time, maternity colonies have been located on the South End of the CNF. No Indiana bats have been captured on the North End of the CNF. However, approximately 13,532 acres of potential summer roosting habitat (mature upland and riparian forests) is available in the BCEA.

Alternative A – This alternative would have no direct, indirect or cumulative effects on Indiana bat because no action would occur. *Determination of effect* – This alternative would have a ***no effect*** determination for **Indiana bat**.

Alternatives B and C – These alternatives would have very similar effects on Indiana bat and will be discussed together. Indiana bats may be directly affected by harvesting (shelterwood, clearcut, overstory removal, white pine thinning, daylighting) and temporary road construction (Alternative B -513 acres, Alternative C -544 acres). If individuals are present in these areas and activities are conducted during the summer, bats roosting in trees that are cut or pushed over may be disturbed, injured or may perish. Effects would be lessened by leaving a residual 15-30 BA per acre in harvested stands. The RLRMP requires the largest trees with favorable conditions for roosting bats to be left. It also requires retention of all shagbark hickory trees (>6 inch diameter) and snags with exfoliating bark. These measures would provide some refuge from harvesting activities. Because Indiana bats have not been found on the North CNF, the likelyhood of these impacts is very low.

These cutting activities would indirectly impact roosting and foraging habitat on less than four percent of potential habitat in the project area (513 acres in Alternative B and 544 acres in Alternative C). Impacts to habitat would be lessened by the retention standards mentioned previously. Suitable roosting habitat would continue to be available in those stands through the next 20 years. New snags would develop from trees damaged during harvest, creating more roosting habitat. Forage production (insects) would increase in harvested stands due to an increase in sunlight and plant diverisity.

Indirect effects from midstory treatments would be beneficial, but slight. Most treatment would focus on trees too small for roosting, but some larger trees (>6 inches diameter) would be treated. When these trees die, they may provide additional roosting habitat a year or two. Creation of eight vernal ponds would improve habitat by supplying water and foraging sources. Installation of bat boxes would provide additional roosting habitat.

Herbicides used in treatments are not likely to come directly in contact with animals or their food sources (flying insects). The herbicides used are no more than slightly toxic for mammals (Tu et al 2001). The very small amounts used and direct methods of applications minimize the risk of contamination and impacts to foraging habitat (insect production). Therefore negative effects are not likely. No other activities listed in Tables 1 and 2 would affect Indiana bat.

Cumulative Effects – Past prescribed burning and other forest management projects, particularly timber harvesting, have had minimal, slightly beneficial impacts. These activities are also likely to occur in the future, resulting in the same type of impacts. Cumulative effects of these past and future activities, combined with the activities proposed in this alternative would be slightly beneficial.

***Determination of effect* – Alternatives B and C are** *not likely to adversely affect* **Indiana bat. Negative effects would be minimal, and some effects would be beneficial.** Informal consultation with the USDI Fish and Wildlife Service (FWS) was initiated in January 2010 and a letter of concurrence was received on May 3, 2010 (Jennings 2010).

Sensitive Species

Carolina mountain dusky salamander *(Desmognathus carolinensis)* is one of the most common species within its range (Petranka 1998). It ranges from the Doe River to the Pigeon River. This species has been found during surveys in the watershed and habitat occurs throughout the project area. Therefore it is highly likely to occur in the treatment areas.

This salamander concentrates near seeps, springs, and streams at lower elevations and during the winter. It may venture into adjacent wooded areas in wet weather and is often found on wet rock faces. It is more terrestrial at higher elevations. It seeks refuge under cover such as rocks and logs in the day (Petranka 1998). It feeds on terrestrial invertebrates and is active both night and day. Approximately 9,251 acres of mature mesic forest, including up to 2,286 acres of riparian forest provide habitat for the mountain dusky salamander in the BCEA.

Alternative A – This alternative would have no direct, indirect or cumulative effects on because no action would occur. *Determination of effect* – This alternative would have ***no impact*** on **Carolina Mountain Dusky salamander.**

Alternatives B and C – These alternatives would have the same effects so they will be discussed together. This alternative would have direct effects on this species. Individuals may be relocated, damaged, or destroyed during harvest activities, particularly during tree felling and temporary road construction when soil would be moved. These direct effects would be short-term, occurring only during the duration of the activities and on a small scale. These salamanders concentrate in riparian forests, where very little activity would occur. Compliance with RLRMP standards, including the stream filter zones, would protect the majority of individuals from harm.

Habitat is scattered throughout the BGEA, and the majority of the populations would not be impacted. Negative and long-term indirect effects would occur on less than two percent of potential habitat (Alternative B-270 acres, Alternative C-301 acres). Harvesting of a white pine

plantation and portions of other harvested stands within coves would increase sunlight to the forest floor causing leaf litter dry-out and increased surface temperatures. This may cause salamanders to relocate to more moist conditions in adjacent stands. Over time, canopy cover would increase to more suitable conditions again and the salamanders should return to the area. Salamanders are known to recolonize a clearcut over 4-15 years and reach pre-harvest levels in up to 20 years (Ash 1997). Although habitat would be reduced, 1,880 acres of mesic forests would mature in the next 20 years, providing a net increase of habitat (Alternative B-1,604 acres, Alternative C-1579 acres). Therefore, the population would persist in the BCEA.

Daylighting along roads, rhododendron thinning and felling of scattered trees for stream habitat improvements would improve up to 159 acres of salamander habitat. These activities would allow more sunlight to the forest floor and increasing forage productivity, while still maintaining moist, shaded conditions. These benefits would last from 5-10 years. Wood left on the ground from stream improvements and timber harvest, plus the addition of ten grouse drumming logs, would provide cover and feeding areas for salamanders and their food sources. The creation of eight waterholes in the project area may create additional habitat providing long-term benefits.

Midstory treatment would still allow shaded conditions and would not affect habitat to any degree. Herbicides used in midstory and NNIS treatments are not likely to come directly in contact with animals, but may be on food sources that are ingested (plants and insects). The herbicides used are no more than slightly toxic for mammals (Tu et al 2001) and present low risk to aquatic species (SERA). However, the impacts of herbicides on amphibians and reptiles are not known. Less than one acre of habitat would be destroyed where temporary road construction occurs. No other activities listed in Tables 1 and 2 would cause any impacts.

Cumulative Effects - Combined with past and future burning and other forest management activities, particularly timber harvesting, this alternative would have a negative cumulative effect on Carolina mountain dusky salamander. However, this species is common throughout its range and populations would persist in the BCEA, so these negative cumulative effects would not contribute to the decline of this species or its habitat across the CNF.

Determination of effect – Implementation of Alternatives B and C ***may impact individuals but is not likely to cause a trend toward federal listing or loss of viability*** of Carolina mountain dusky salamander**.**

Southern Appalachian salamander *(Plethodon teyahalee)* occurs in the Blue Ridge physiographic province west of the French Broad River. It is stable and unthreatened on a range-wide basis. This species has been found during surveys in the watershed and habitat occurs throughout the project area. Therefore it is highly likely to occur in the treatment areas.

It prefers mature, deciduous, mesic forests (up to 4900 feet in elevation) with downed wood and rocks. It is a terrestrial breeder, spending much of its time underground (Petranka 1998). Juveniles and adults feed on forest floor invertebrates and are most active at night, especially rainy ones. The home range typically includes a retreat hole (Mitchell 2001), often in road banks. Approximately 8,782 acres of mature mesic deciduous forest provide habitat for the Southern Appalachian salamander in the BCEA.

Alternative A – This alternative would have no direct, indirect or cumulative effects on the Southern Appalachian salamander because no action would occur. *Determination of effect* – This alternative would have ***no impact*** on **Southern Appalachian salamander.**

Alternatives B and C – These alternatives would have the same effects so they will be discussed together. This alternative would have direct effects on this species. Individuals may be relocated, damaged, or destroyed during harvest activities, particularly during tree felling and temporary road construction when soil would be moved. However, these salamanders are nocturnal and would be underground when activities are taking place, and by and large would be protected. These direct effects would be short-term, occurring only during the duration of the activities and on a small scale. Compliance with RLRMP standards, including the stream filter zones, would protect individuals in riparian areas from harm.

Habitat is scattered throughout the BGEA, and the majority of the populations would not be impacted. Negative and long-term indirect effects would occur on up to three percent of potential habitat (Alternative B-242 acres, Alternative C-273 acres). Shelterwood cutting would increase sunlight to the forest floor causing leaf litter dry-out and increased surface temperatures. This may cause salamanders to relocate to more moist conditions in adjacent stands. Over time, canopy cover would increase to more suitable conditions again and the salamanders should return to the area. Salamanders are known to recolonize a clearcut over 4-15 years and reach pre-harvest levels in up to 20 years (Ash 1997). Although habitat would be reduced, 1,111 acres of mesic deciduous forests would mature in the next 20 years, providing a net increase of habitat (Alternative B-869 acres, Alternative C-838 acres). Therefore, the population would persist in the BCEA.

Daylighting along roads, rhododendron thinning and felling of scattered trees for stream habitat improvements would improve up to 159 acres of salamander habitat. These activities would allow more sunlight to the forest floor and increasing forage productivity, while still maintaining moist, shaded conditions. These benefits would last from 5-10 years. Wood left on the ground from stream improvements and timber harvest, plus the addition of ten grouse drumming logs, would provide cover and feeding areas for salamanders and their food sources. The creation of eight waterholes in the project area may create additional habitat providing long-term benefits.

Midstory treatment would still allow shaded conditions and would not affect habitat to any degree. Herbicides used in midstory and NNIS treatments are not likely to come directly in contact with animals, but may be on food sources that are ingested (plants and insects). The herbicides used are no more than slightly toxic for mammals (Tu et al 2001) and present low risk to aquatic species (SERA). However, the impacts of herbicides on amphibians and reptiles are not known.

Less than one acre of habitat would be destroyed where temporary road construction occurs. However, these salamanders have frequently been observed using tunnels in road cuts on the CNF, so negative impacts from this activity would be temporary. Once construction and timber harvesting are complete, salamanders would be able to use the area again. No other activities listed in Tables 1 and 2 would cause any impacts.

Cumulative Effects - Combined with past and future burning and other forest management activities, particularly timber harvesting, this alternative would have a negative cumulative effect on Southern Appalachian salamander. However, this species is common throughout its range and populations would persist in the BCEA, so these negative cumulative effects would not contribute to the decline of this species or its habitat across the CNF.

Determination of effect – Implementation of Alternatives B and C ***may impact individuals but is not likely to cause a trend toward federal listing or loss of viability*** of Southern Appalachian salamander**.**

Diana fritillary (*Speyeria diana)* is primarily found in the mountains from central Virginia and West Virginia to north Georgia and Alabama. It is somewhat more abundant from southwestern Virginia to the Great Smokies region and is rare and sporadic elsewhere. It apparently underwent a major range wide decline in the past resulting in a substantial loss of its historic range. However, some believe it is increasing in areas where second growth forests are becoming mature, and where gypsy moth spraying is not widespread (NatureServe 2007). It occurs across the northern CNF and has been observed by district biologists in at least 26 locations in recent years. This species has been observed in the BCEA, and habitat occurs throughout the project area. Therefore it is highly likely to occur in the treatment areas.

Adults breed in deciduous or mixed forests with abundant violets in late summer. The larvae hatch in the fall, over-winter, and begin feeding on violets in early spring. Adults feed on nectar from flowers in open areas and also are found on scat and moist soil. Because adults and larvae require different types of habitat in substantial amounts, the home ranges of these butterflies require large areas of land with diverse habitats (NatureServe 2007). Approximately 8,782 acres of mature mesic deciduous forest provide breeding and caterpillar habitat for Diana fritillary in the BCEA. Adult feeding habitat is available in most areas of the BCEA (16,777 acres).

Alternative A – This alternative would have no direct effects on the Diana Fritillary because no action would occur. Diana fritillary would be indirectly impacted because habitat diversity would decline in the next 20 years as forests mature into the later age classes, reducing the amount of adult foraging habitat. *Determination of effect* – This alternative ***may impact individuals but is not likely to cause a trend toward federal listing or loss of viability*** of Diana fritillary**.**

Alternatives B and C – These alternatives would have the same effects so they will be discussed together. This alternative would have direct effects on this species. Adults and caterpillars may be impacted during shelterwood harvest. Caterpillars may perish from temporary road construction and tree cutting. Adults that are roosting in trees or on the ground may also perish. However, adults would be able to move from the area during disturbance. These direct effects would be short-term, occurring only during the duration of the activities and on a small scale. Compliance with RLRMP standards, including the stream filter zones, would protect individuals in riparian areas from harm.

Habitat is scattered throughout the BGEA, and the majority of the populations would not be impacted. Long-term indirect effects would occur on up to three percent of potential caterpillar

habitat (Alternative B-242 acres, Alternative C-273 acres). Shelterwood cutting would increase sunlight to the forest floor. Increased sunlight may decrease favorable conditions for growth of violets, the food source for caterpillars. Within five years, as the forest regenerates and post harvest treatments thin the regrowth, light intesity would return to more favorable conditions for caterpillars and their food source. However, conditions may not be optimal until the forests matures again. Although caterpillar habitat would be reduced, 1,111 acres of mesic deciduous forests would mature in the next 20 years, providing a net increase of habitat (Alternative B-869 acres, Alternative C-838 acres).

The increased sunlight from timber harvesting would promote growth of flowering plants for at least five years and would be beneficial for adults when nectar gathering. The amount of adult feeding habitat would increase by up to 296 acres in Alternative B and 327 acres in Alternative C. Therefore, the population would persist in the BCEA.

Midstory treatment and crop tree release would only impact smaller trees, still allowing shaded conditions. This type of activity would not affect habitat to any degree. Herbicides are not likely to come in contact with individuals in the affected areas because they are applied directly to the targeted species. Herbicides used in treatments are not likely to come directly in contact with animals, but may be on food sources that are ingested (plants). The herbicides used appear to be relatively non-toxic for invertebrates (Tu et al 2001 and SERA); although very little information is available for insects.

Daylighting along roads, rhododendron thinning and felling of scattered trees for stream habitat improvements would improve roughly 159 acres of breeding and caterpillar habitat. These activities would allow more sunlight to the forest floor and increasing forage productivity, while still maintaining moist, shaded conditions. Permanent open area management and improvements would have beneficial indirect effects on adult habitat. Flowering plants in these openings would provide abundant feeding habitat. These benefits would last from 5-10 years. The overall increase in habitat diversity across the BCEA from Alternatives B and C would benefit Diana fritillary. No other activities listed in Tables 1 and 2 would cause any impacts.

Cumulative Effects - Combined with past and future burning and other forest management activities, particularly timber harvesting, this alternative would have a beneficial cumulative effect on Diana fritillary. These activities in combination maintain a diverse and healthy habitat for this species.

Determination of effect – Implementation of Alternatives B and C ***may impact individuals but is not likely to cause a trend toward federal listing or loss of viability*** of Diana fritillary**.**

Rafinesque's big-eared bat (*Corynorhinus rafinesquii)* ranges widely in forested regions of the southern states from Virginia, West Virginia, Ohio, Indiana, and Illinois south to the Gulf of Mexico, west to Louisiana, Oklahoma, and eastern Texas. Hibernation most often occurs in small caves or similar sites (near the entrance) and move about in winter. Summer roosts (particularly maternity colonies) are in large hollow trees, abandoned buildings in wooded areas, or cave like habitats. They forage primarily in upland and riparian forests, both young and old (NatureServe 2009).

An effort of forest-wide sampling from 1990 to 2007 with over 800 net nights, capturing over 2400 bats, documented this bat in only one location on the North CNF (Cocke County). This location is in an adjacent watershed and these bats are likely to occur in the BCEA. Approximately 13,532 acres of potential summer roosting habitat (mature upland and riparian forests) is available, and foraging habitat occurs across the majority of the BCEA.

Eastern small-footed bat *(Myotis leibii)* is moderately widespread with spotty distribution from southeastern Canada to Alabama and Georgia, west to Oklahoma. In summer they roost in rock outcrops and cliffs, rock crevices, caves, mines, bridges, trees, and buildings. Rocky areas or bridges with sun exposure in a forested landscape may be important maternity site features. These bats hibernate singly or in small groups in caves, mines and buildings. They hibernate only in coldest periods of winter and early spring in caves and mines (Harvey, et al 1999). They typically forage over streams, ponds, and waterholes (NatureServe 2007).

An effort of forest-wide sampling from 1990 to 2007 with over 800 net nights, capturing over 2400 bats, has documented 125 small-footed bats and several maternity colonies spread across most counties of the CNF. Surveys in the BCEA located a maternity colony of Eastern small-footed bats and found bats foraging in the area. Approximately 13,532 acres of potential summer roosting habitat (mature upland and riparian forests) is available in the BCEA.

The effects to Rafinesque's big-eared bat and Eastern small-footed bat would be the same, so they will be addressed together.

Alternative A – This alternative would have no direct, indirect or cumulative effects on Rafinesque's big-eared bat (RBEB) and Eastern small-footed bat (ESFB) because no action would occur. *Determination of effect* – Alternative A would have ***no impact*** on Rafinesque's big-eared and eastern small-footed bats**.**

Alternatives B and C – These alternatives would have very similar effects on these bats and will be discussed together. RBEB and ESFB may be directly affected by harvesting (shelterwood, clearcut, overstory removal, white pine thinning, daylighting) and temporary road construction (Alternative B- 513 acres, Alternative C- 544 acres). If individuals are present in these areas and activities are conducted during the summer, bats roosting in trees that are cut or pushed over may be disturbed, injured or may perish. Effects would be lessened by leaving a residual 15-30 BA per acre in harvested stands. The RLRMP requires the largest trees with favorable conditions for roosting bats to be left. It also requires retention of all shagbark hickory trees (>6 inch diameter) and snags with exfoliating bark. These measures would provide some refuge from harvesting activities.

Large, hollow trees (RBEB maternity colonies) would be retained and rock outcrops (ESFB maternity colonies) would not be damaged, although harvesting activities may disturb bats in these colonies while they are sleeping during the day. These impacts would be short-term, only lasting through the duration of the activities. The maternity colony that has been documented in the BCEA would not be impacted in any way.

The cutting activities would indirectly impact roosting and foraging habitat on less than four percent of potential habitat in the project area (Alternative B- 513 acres, Alternative C- 544 acres). Impacts to habitat would be lessened by the retention standards mentioned previously. Suitable roosting habitat would continue to be available in those stands through the next 20 years. New snags would develop from trees damaged during harvest, creating more roosting habitat. Forage production (insects) would increase in harvested stands due to an increase in sunlight and plant diverisity.

Indirect effects from midstory treatments would be beneficial, but slight. Most treatment would focus on trees too small for roosting, but some larger trees (>6 inches diameter) would be treated. When these trees die, they may provide additional roosting habitat a year or two. Creation of vernal ponds would improve habitat by supplying water and foraging sources. Installation of bat boxes would provide additional roosting habitat.

Herbicides used in treatments are not likely to come directly in contact with animals or their food sources (flying insects). The herbicides used are no more than slightly toxic for mammals (Tu et al 2001). The very small amounts used and direct methods of applications minimize the risk of contamination and impacts to foraging habitat (insect production), and negative effects are not likely. No other activities listed in Tables 1 and 2 would affect RBEB and ESFB.

Cumulative Effects – Past prescribed burning and other forest management projects, particularly timber harvesting, have had minimal, slightly beneficial impacts. These activities are also likely to occur in the future, resulting in the same type of impacts. Cumulative effects of these past and future activities, combined with the activities proposed in this alternative would be slightly beneficial.

Determination of effect – Implementation of the project ***may impact individuals but is not likely to cause a trend toward federal listing or loss of viability*** of Rafinesque's big-eared and eastern small-footed bats**.**

Delicate vertigo (*Vertigo bollesiana)* is scattered from Maine west to Minnesota, and south to Tennessee and North Carolina (NatureServe 2007). This snail is found in leaf litter on wooded hillsides, marshes, cold talus slopes, and cliffs (NatureServe 2007). It has been recorded in three locations in Monroe and Johnson Counties of the CNF. Surveys have documented the occurrence of this species in the BCEA. Approximately 12,312 acres of potential habitat (mature deciduous forests) is available.

Alternative A – This alternative would have no direct, indirect or cumulative effects on delicate vertigo because no action would occur. *Determination of effect* – Alternative A would have ***no impact*** on delicate vertigo**.**

Alternatives B and C – These alternatives would have the same effects so they will be discussed together. This alternative would have direct effects on this species. Individuals may be relocated or crushed during harvest activities (Alternative B-513 acres, Alternative C-544 acres), particularly during tree felling and temporary road construction when soil would be moved. These direct effects would be short-term, occurring only during the duration of the activities and on a small scale. Individuals in underground retreats, the base of trees, and under large logs on

the ground would be more protected from direct impacts. Compliance with RLRMP standards, including the stream filter zones, would protect individuals in riparian areas from harm.

Habitat is scattered throughout the BGEA, and the majority of the populations would not be impacted. Negative and long-term indirect effects would occur on roughly two percent of potential habitat (Alternative B-268 acres, Alternative C-273 acres). Shelterwood cutting would increase sunlight to the forest floor causing leaf litter dry-out and increased surface temperatures. This may cause snails to relocate to more moist conditions in adjacent stands. However, snails are able to survive dry periods by sealing their openings with mucous to prevent moisture loss, and may be able to remain this way for years (Burch and Pearce 1990). Habitat would remain in harvested areas in the form of underground retreats, slash piles, and logs on the ground. This refuge is the most important limiting factor for these animals, protecting them from dry conditions and predators (Burch and Pearce 1990). Five years after harvest, canopy cover would begin to increase to more suitable conditions again and the snails should return to the area over time. Although habitat would be reduced, 1,110 acres of deciduous forests would mature in the next 20 years, providing a net increase of of habitat (Alternative B-842 acres, Alternative C- 837 acres). Therefore, the population would persist in the BCEA.

Daylighting along roads, rhododendron thinning and felling of scattered trees for stream habitat improvements would improve have little if any impacts to snail habitat. These activities would maintain moist, shaded conditions. Wood left on the ground from stream improvements and timber harvest, plus the addition of ten grouse drumming logs, would provide cover and feeding areas for these snails.

Midstory treatment would still allow shaded conditions and would not affect habitat to any degree. Herbicides used in midstory and NNIS treatments are not likely to come directly in contact with snails, but may be on food sources that are ingested (plants). The herbicides used appear to be relatively non-toxic for invertebrates (Tu et al 2001 and SERA), although no information is available for terrestrial snails.

Less than one acre of habitat would be destroyed where temporary road construction occurs, but negative impacts from this activity would be temporary. Road construction and maintenance would have some beneficial indirect effects. The addition of gravel on these roads would provide an additional source of calcium needed for shell production (Burch and Pearce 1990). Once construction and timber harvesting are complete, snails would be able to use the area again. No other activities listed in Tables 1 and 2 would cause any impacts.

Cumulative Effects - Combined with past and future burning and other forest management activities, particularly timber harvesting, this alternative would have a negative cumulative effect on GS, BD, and DV. However, this species is common throughout its range and populations would persist in the BCEA, so these negative cumulative effects would not contribute to the decline of this species or its habitat across the CNF.

Determination of effect – Implementation of Alternatives B and C ***may impact individuals but is not likely to cause a trend toward federal listing or loss of viability*** of delicate vertigo**.**

Butternut *(Juglans cinerea)*, a formerly common tree, ranges across most of the eastern United States except the Deep South. It is known from all Blue Ridge counties and scattered westward throughout the state with at least 11 known locations on the CNF. Butternut canker disease has severely depleted populations, and the species is considered to be in severe decline (NatureServe 2009). Two specimens were found in the project area. One was found close to the road in an area that will not be manipulated by this project, and one was found in an old shelterwood that is going to have the overstory trees taken out.

Its general habitat is moist, rich forests. In Tennessee, it is usually found in creek bottoms in mesic forests and lower slopes. Butternut is shade-intolerant, growing best in full sunlight (NatureServe 2009). Approximately 10,376 acres of mesic deciduous forest provide potential habitat for butternut in the BCEA.

Alternative A – This alternative would have no direct, indirect or cumulative effects on butternut because no action would occur and existing habitat would remain. *Determination of effect* – Alternative A would have ***no impact*** on butternut**.**

Alternatives B and C – These alternatives would have the same effects so they will be discussed together. Negative direct effects to this species would be minimal. Butternut trees would be protected from cutting or treating with herbicides during overstory removal and other treatments. If other trees are felled and hit butternut trees, some damage may occur, possibly reducing their health and making them succumb faster to the butternut canker disease. Herbicides are not likely to come in contact with individuals because they are applied directly to the targeted species in weather conditions that minimize drift and movement of the herbicide.

Indirect effects to this species would be positive. Young butternut trees do not withstand overhead shading. Reproduction is successful only in areas where shade does not inhibit its growth, such as stand openings (NatureServe 2009). Because this tree is shade-intolerant and grows best in full sunlight, harvest would create conditions favorable for possible establishment on additional acres (Alternative B-242, Alternative C-273). Populations should recover from any losses associated with implementation, and actions would improve or maintain habitat in the area on a long-term basis. No other activities listed in Tables 1 and 2 would cause any impacts.

Cumulative Effects - Combined with past and future burning and other forest management activities, particularly timber harvesting, this alternative would have a positive cumulative effect on butternut. Maintenance of open habitats through these actions promote the spread and continuation of this species. However, the beneficial effects from management would not offset the greatest negative effects from butternut canker.

Determination of effect - Implementation of the project ***may impact individuals but is not likely to cause a trend toward federal listing or loss of viability*** of butternut**.**

Small's beardtongue (*Penstemon smallii)* is restricted to the southern Appalachians and is most common in North Carolina and South Carolina. It is known from Polk, Cocke, Greene, Washington, Unicoi, and Carter Counties. It is intrinsically threatened by its limited distribution, with its only stable populations occurring in the mountains of western North Carolina

(NatureServe 2009). This plant was found in one location along a road proposed for daylighting.

It occurs in woodlands, cliffs, glades, and road banks (Weakley 2005 draft). Habitat is available in up to 98 acres of permanent openings and along road sides in the BCEA.

Alternative A – This alternative would have no direct, indirect or cumulative effects on Small's beardtongue because no action would occur and existing habitat would remain. *Determination of effect* – Alternative A would have ***no impact*** on Small's beardtongue**.**

Alternatives B and C – These alternatives would have the same effects so they will be discussed together. The area surrounding the individual plants located along the road would be protected from cutting activities and herbicide treatments and would not be directly impacted. Herbicides are not likely to come in contact with individuals because they are applied directly to the targeted species in weather conditions that minimize drift and movement of the herbicide.

Indirect effects to this species would be positive. Since this species is commonly found along road banks, the increased sunlight exposure caused by tree cutting along the road where it is found may aid in the spread of the species. These benefits would last for at least five years after cutting. Construction of temporary road and skid trails may create additional habitat. Wildlife opening maintenance and old field restoration would also benefit this species by maintaining favorable open conditions. No other activities listed in Tables 1 and 2 would cause any impacts.

Cumulative effects – Combined with past and future burning and other forest management activities, particularly timber harvesting, this alternative would have a positive cumulative effect on Small's beardtongue. Maintenance of open habitats through these actions promotes the spread and continuation of this species.

Determination of effect – Implementation of the project ***may impact individuals but is not likely to cause a trend toward federal listing or loss of viability*** of Small's beardtongue.

Roan Mountain rattlesnake root (*Prenanthes roanensis)* is an Appalachian endemic known from southwestern Virginia, east Tennessee, and western North Carolina (Weakley 2005 draft). In Tennessee, this plant is known from Carter, Greene, Unicoi, Sevier, Polk Johnson and Sullivan counties (UTK 2006). Roan Mountain rattlesnake root has been found in at least 48 locations on the CNF. This plant was documented within 4 stands surveyed for this analysis.

It occurs in a wide variety of habitats usually above 3,500 feet including road banks, cliffs, trails, balds, and rich, open forests. Roan Mountain rattlesnake root prefers more open sites and is capable of withstanding and colonizing areas where mowing, timber removal, or road maintenance has occurred. Quantifying the amount of potential habitat in the BCEA is difficult, as existing data does not characterize the open conditions of forested stands. Habitat is available in up to 98 acres of permanent openings and along road sides in the BCEA.

Alternative A – This alternative would have no direct effects on Roan Mountain rattlesnake root because no action would occur. Roan Mountain rattlesnake root would be indirectly impacted because habitat diversity would decline in the next 20 years as forests mature into the later age classes, reducing the amount open habitats. *Determination of effect* – This alternative ***may***

impact individuals but is not likely to cause a trend toward federal listing or loss of viability of Roan Mountain rattlesnake root**.**

Alternatives B and C – These alternatives would have the same effects so they will be discussed together. Tree cutting could have negative direct effects on the individuals found in two stands proposed for harvesting. These activities could crush or uproot plants. Herbicides are not likely to come in contact with individuals because they are applied directly to the targeted species in weather conditions that minimize drift and movement of the herbicide. These negative effects are small in scale and would be short-term, lasting while the activities were ongoing. Road construction would occur at a lower elevation, outside of suitable habitat for this species. The other two known locations are located in areas where no activities are proposed and so would not be impacted.

Indirect effects to this species from these alternatives would be positive. Shelterwood harvest in these two stands would have no lasting negative effects and could be beneficial. Because this is a plant of open areas, shelterwood cutting, thinning, and daylighting roads would create more potential habitat (166 in Alternative B and 197 in Alternative C). This would be short-term, for the most part, lasting only for the first five years after harvesting. Open conditions on skid roads may last longer.

Midstory treatment, crop tree release, rhododendron thinning, and cutting trees for stream improvements would increase light reaching the forest floor and may provide opportunities for expansion or colonization within treated areas. Maintenance and creation of wildlife openings would also maintain suitable habitat in the BCEA. Populations should recover from any losses associated with implementation, and actions would improve or maintain habitat in the area on a long-term basis. No other activities listed in Tables 1 and 2 would cause any impacts.

Cumulative effects – Combined with past and future burning and other forest management activities, particularly timber harvesting, this alternative would have a positive cumulative effect on Roan Mountain rattlesnake root. Maintenance of open habitats through these actions promotes the spread and continuation of this species.

Determination of effect - Implementation of Alternatives B and C ***may impact individuals but is not likely to cause a trend toward federal listing or loss of viability*** of Roan Mountain rattlesnake root.

Blue Ridge catchfly (*Silene ovata)* range is centered in the southern Appalachians (Virginia, Kentucky, Tennessee, North Carolina, South Carolina, and Georgia) and extending to Alabama, Mississippi, and Arkansas. At least 4 occurrences have been documented on the CNF. Only two specimens of Blue Ridge catchfly are located within the project area.

It inhabits mid elevation rich coves, and dry to mesic, oak/hickory forests over mafic or calcareous soils. In Tennessee it occurs in open or forested habitats with sandy or pebbly soils (NatureServe 2007). Quantifying the amount of potential habitat in the BCEA is difficult, as existing stand data does not characterize the soil types.

Alternative A – This alternative would have no direct, indirect or cumulative effects on Blue Ridge catchfly because no action would occur and existing habitat would remain. *Determination of effect* – Alternative A would have ***no impact*** on Blue Ridge catchfly**.**

Alternatives B and C – These alternatives would have the same effects so they will be discussed together. Both of the specimens are located in outside activity areas and should not be affected by project activity. Minor negative direct effects could occur as a result of tree felling along streams, if individuals are located there. These activities could crush plants, but would not damage rootstock. These negative effects are small in scale and would be short-term, lasting while the activities were ongoing.

Because this species occurs in open and forested habitats, small changes in light intensity from cutting trees along streams would not have an indirect effect on this species or its habitat. No other activities listed in Tables 1 and 2 would cause any impacts.

Cumulative effects – Combined with past and future burning and other forest management activities, this alternative would have no cumulative effects on Blue Ridge catchfly.

Determination of effect – Alternatives B and C ***may impact individuals but is not likely to cause a trend toward federal listing or loss of viability*** Blue Ridge catchfly.

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